ated with increased uptake of pertechnetate Tc 99m on scintigraphy.

CAROL S. MARCUS, MD
W. H. BLAHD, MD

REFERENCES

Berquist TH, Nolan NG, Stephens DH, et al: Specificity of ^{99m}Tc-pertechnetate in scintigraphic diagnosis of Meckel's diverticulum: Review of 100 cases. J Nucl Med 17:465-469, Jun 1976

Sailer JF, Janeway CM: Pertechnetate demonstration of a Barrett's esophagus involving the length of the esophagus (Letter). J Nucl Med 19:1366-1368, Dec 1978

Sciarretta G, Malaguti P, Turba E, et al: Retained gastric antrum syndrome diagnosed by ^{99m}Tc-pertechnetate scintiphotography in man: Hormonal and radioisotopic study of two cases. J Nucl Med 19:377-380, Apr 1978

Hepatobiliary Imaging by Radionuclide Scintigraphy

RADIONUCLIDE IMAGING of the hepatobiliary system has been substantially improved with the introduction of compounds tagged with technetium 99m. The two radioactive pharmaceutical agents most commonly used are the N-substituted iminodiacetic acid (IDA) derivatives HIDA (dimethyl-IDA) labeled with ^{99m}Tc and PIPIDA (para-isopropyl-IDA) labeled with ^{99m}Tc. These agents offer substantial advantages over the previously used agent rose bengal ^{131}I (8.1 days physical half-life), including a short six-hour physical half-life, better counting statistics and relatively low radiation dose to the patient.

The radionuclide is removed rapidly from the blood by the polygonal cells of the liver. The liver is visualized within 5 minutes, and within 15 to 30 minutes most of the radioactive material has been removed from the bloodstream and concentrated by the liver. The gallbladder is seen in 30 to 60 minutes, and radioactivity is identified in the gastrointestinal tract usually by the end of the first hour.

These agents are capable of visualizing the biliary system at bilirubin levels of up to 8 mg per dl; at higher levels (>10 mg per dl), PIPIDA ^{99m}Tc is the preferred agent. This technique has a considerable advantage over intravenous cholangiography, in which biliary visualization diminishes rapidly when the bilirubin level rises to 2 to 4 mg per dl. Also, it provides an ideal study medium for patients who are allergic to radiographic contrast media.

Radionuclide cholescintigraphy has considerably reduced the need for intravenous cholangiography in the diagnosis of acute cholecystitis because a normal study in effect excludes this diagnosis. In jaundiced patients, it can be used to distinguish biliary tract obstruction from hepatocellular disease. These agents are also useful in determining postoperative patency of biliary anastomoses, in evaluating defects seen on technetium 99m sulfur colloid liver scans and in evaluating suspected biliary atresia in infants.

An important advantage of cholescintigraphy over ultrasonography and computed tomography is that the former provides both physiological and anatomical measures of hepatobiliary diseases, whereas the latter two provide only anatomical information.

RAKHI RAM, MD
NORMAN POE, MD

REFERENCES

Cheng TH, Davis MA, Seltzer SE, et al: Evaluation of hepatobiliary imaging by radionuclide scintigraphy, ultrasonography and contrast cholangiography. Radiology 133:761-767, Dec 1979

Fonseca C, Greenberg D, Rosenthall L, et al: Assessment of the utility of gallbladder imaging with 99m Tc-IDA. Clin Med 3:437-441, Nov 1978

Weissmann HS, Frank M, Rosenblatt R, et al: Cholescintigraphy, ultrasonography and computerized tomography in the evaluation of biliary tract disorders. Semin Nucl Med 9:22-35, Jan 1979

Serum Thyroglobulin Levels: Their Use in Monitoring Thyroid Carcinoma

THE DETERMINATION of serum thyroglobulin levels, a major thyroid protein prohormone and the site of synthesis of thyroid hormone, represents an important advance in monitoring the disease course of patients with differentiated thyroid carcinoma. With the recent development of commercial radioimmunoassay kits for serum thyroglobulin, the assay will be more widely available to clinicians. It must be emphasized that thyroglobulin is *not* the same entity as thyroxine-binding globulin, a major binder of thyroid hormone in the blood.

In patients with papillary, follicular or mixed papillary-follicular tumors who have had subtotal thyroidectomy and subsequent ablation with iodide I 131, serum levels of thyroglobulin will become low or undetectable several weeks after treatment. However, thyroglobulin levels will be elevated in patients with widely metastatic disease. The level of thyroglobulin may be a more sensitive indicator of the presence of recurrent disease than standard iodide I 131 metastatic scans. In some cases thyroglobulin levels will be abnormal, while no abnormal uptake of radioactive iodine is noted on imaging. Other advantages of the technique include the ability to do the assay while the patient is receiving thyroid replacement therapy. However, if levels are undetectable, the assay should be repeated after terminating replacement therapy. Because thyroglobulin antibodies interfere with the assay and may invalidate results, the patient's serum specimens should be screened for antibodies before measuring thyroglobulin levels.

Thyroglobulin levels are useful indicators in patients rendered athyrotic because detectable levels of thyroglobulin can be identified in persons without thyroid disease and elevated levels can be seen in patients with autoimmune disease of the thyroid. However, the level of thyroglobulin is of no value in the separation of benign from malignant thyroid nodules.

MARTIN A. SCHWARTZ, MD
W. H. BLAHD, MD

REFERENCES

Van Herle AJ, Vassart G, Dumont JE: Control of thyroglobulin synthesis and secretion. N Engl J Med 301:239-249, 307-314, Aug 2, 1979, Aug 9, 1979

Schlossberg AH, Jacobson JC, Ibbertson HK: Serum thyroglobulin in the diagnosis and management of thyroid carcinoma. Clin Endocrin 10:17-27, Jan 1979

Regional Cerebral Blood Flow

IN CONTRAST to the qualitative estimate of cerebral blood flow obtained with a routine brain scan, a more precise estimation of regional cerebral blood flow can be obtained using freely diffusible xenon 133 gas. The washout of the radioactive gas from the head is monitored using either one or several radiation detection probes to calculate cerebral blood flow. Xenon 133 may be injected into the internal carotid artery by way of catheter or peripherally into a vein, or it may be inhaled and passed into the bloodstream by way of the pulmonary capillaries. Although the amount of blood flow in grey matter is of greatest importance, the probes can measure radioactivity in white matter and, with intravenously given or inhaled xenon 133, in extracerebral tissues as well. To differentiate between these compartments, washout is monitored for at least ten minutes. The first portion of the biphasic washout curve is assumed to be produced by activity in the grey matter, with the second portion primarily produced by activity in the white matter and extracerebral tissue. Equations derived from the Fick principle are applied to the curve to calculate regional blood flow in both white and grey matter. Sources of error include scattered radiation from outside the probe field of view, an unknown contribution to the count rate from extracerebral tissues and the pronounced effect of the partition coefficient (or differential solubility in tissue) of ^{133}Xe, which may vary greatly in areas of abnormal tissue.

In spite of the sources of error, the procedure provides sufficient information to be useful in the diagnosis and follow-up after surgical treatment of cerebrovascular disease. It is also useful in conditions of low blood flow such as dementia and after severe head injuries as well as to show the response to ventricular shunting in normal pressure hydrocephalus.

Because of the value of quantitating cerebral blood flow, better methods of estimation are being sought. One involves use of krypton 81m, a gas with a 13-second half-life, to show arterial flow. Others use an emission computed tomographic scanner, with a positron-emitting radionuclide to demonstrate distribution of blood flow in the brain. As yet, these methods are confined to a few research centers.

NORAH MILNE, MD
KENNETH P. LYONS, MD

REFERENCES

Holman BL: Concepts and clinical utility of the measurement of cerebral blood flow. Semin Nucl Med 6:233-251, Jul 1976

Obrist WD, Thompson HK Jr, Wang HS, et al: Regional cerebral blood flow estimated by 133-xenon inhalation. Stroke 6:245-256, May-Jun 1975

Phelps ME: Emission computed tomography. Semin Nucl Med 7:337-365, Oct 1977

Melamed E, Lavy S, Bentin S, et al: Reduction in regional cerebral blood flow during normal aging in man. Stroke 11:31-35, Jan-Feb 1980

Adrenal Scintigraphy

IN 1970 iodocholesterol labeled with iodine 131 was introduced for scanning the adrenal glands. Since 1975 iodomethylnorcholesterol ^{131}I has been the agent of choice because of its higher organ-to-background ratio. Adrenal scintigraphy can be used to demonstrate adrenal structure and function in a manner similar to radioactive iodine scintigraphy being used for the thyroid gland. In more than 95 percent of cases of Cushing syndrome, the adrenal scan can differentiate between hyperplasia, carcinoma or adenoma. An autonomously functioning, unilateral, adrenal adenoma can be detected before the disease is evident clinically, even when plasma cortisol levels are still normal.

Adrenal scintigraphy is the most sensitive method for localizing hyperfunctioning adrenal remnants following bilateral adrenalectomy. Adrenal suppression with dexamethasone can be used to demonstrate aldosterone- or androgen-producing adenomas which appear as a unilateral increase in uptake. The specificity of suppression scans for lateralizing aldosterone-secreting tumors is 94 percent. The advantage of this method is the elimination of adrenal arteriography and venography particularly when the scan demonstrates unilateral pathology. These radioactive cholesterol agents do not concentrate in medullary tissue; therefore, the procedure is less sensitive